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**Berkeley Lab Researchers Find Modest but Diverse Price Response from Large Electricity Customers on Day-Ahead Hourly Pricing at Niagara Mohawk, a National Grid Company**

Day-ahead Market Indexed Pricing, Combined with Emergency Demand Response Programs, Encourages Large Customer Demand Response and Retail Competition

Berkeley, CA—In a new study, researchers at the Department of Energy's Lawrence Berkeley National Laboratory (Berkeley Lab) and Neenan Associates find that large electricity customers exposed to day-ahead hourly pricing respond to high price events with modest overall load reductions, but that individual customers' response is extremely varied, even within customer market segments.

The research, funded by the California Energy Commission (CEC)'s Public Interest Energy Research (PIER) program and coordinated by the Demand Response Research Center (DRRC), represents the second phase of a case study of 149 large electricity users served by Niagara Mohawk, a National Grid Company. These customers have faced hourly prices indexed to the New York Independent System Operator (NYISO)'s day-ahead market since retail choice was adopted in 1998. National Grid supported the project, providing access to customers and their information.

Charles Goldman, the report's lead author, points out, "This group of customers was the first in the U.S. to experience day-ahead hourly pricing as the default-service tariff in the context of retail competition. Their response to the complex choices they've faced – including switching to competitive suppliers, purchasing electricity price hedges, and participating in NYISO's emergency demand response (DR) programs – provides a wealth of information for policymakers interested in dynamic pricing to encourage DR and retail market development."

Bernie Neenan, who led the Neenan Associates research team, adds, "This second phase of the study is an important addition to this work – we collected targeted survey data from a larger sample of customers and used a more flexible demand model to quantify customer response over five summers: 2000 to 2004.

This allowed us to better characterize the diversity of response among large customers than previous studies of price response have done.”

### *Large Customers’ Price Responsiveness is Diverse*

Overall, the study team found that the price response of 119 customers included in an electricity demand model was consistent with other studies of large customers subjected to RTP – the average elasticity of substitution was 0.11. This means that these customers reduce their peak-period electricity usage by 11% (relative to off-peak usage) when the ratio of peak to off-peak prices doubles. In aggregate, the researchers estimate that these customers reduced their aggregate peak demand – typically about 500 MW – by about 10% on days when peak prices were substantially higher, by a factor of five or more, than off-peak prices.

Some interesting aspects of price response among and within customer groups were observed. Goldman emphasizes that “about 20% of customers provided 80% of the overall price response, even though two-thirds of customers had positive elasticities.” “Customers involved in manufacturing industries showed the highest overall response, but looking at these customers individually, we see that the distribution of response is bimodal – manufacturing customers are either very price responsive, or not at all”, says Neenan. He adds, “Government and education customers are also quite price responsive, but are characterized by a more even distribution of elasticities.”

The average elasticity of manufacturing customers is 0.16. The average government/education customer has an elasticity of 0.10. Health care, commercial/retail and public works customers were found to have relatively low response (below 0.04).

The researchers also asked customers how they manage load in response to prices and/or NYISO’s declared emergency events. More than two-thirds of the 76 respondents said they could curtail load: 22% could shift load to another time, 45% reported foregoing load and not making it up later, and 16% said they respond by activating onsite generation. Thirteen percent reported more than one strategy. Catherine McDonough, Supervisor of Electric Pricing and National Grid’s project manager for the study, stated that, “We are pleased to see that real-time pricing—especially when combined with NYISO DR programs—seems to be encouraging demand response while expanding customer choice. Creating a real-time pricing option for our largest customers is an important component of National Grid’s long-standing commitment to supporting the success of New York’s competitive electricity markets.”

### *NYISO Emergency DR Programs Complement RTP*

Forty-two percent of the 149 study customers were enrolled in NYISO's emergency DR programs for at least one summer since 2001, allowing the researchers to investigate the impact these programs have on customers' price response.

The study team found a statistical correlation between customers' participation in NYISO's Emergency Demand Response Program and their price responsiveness. Bernie Neenan notes, "Customers told us in surveys that they respond to NYISO events, directly or indirectly. Not only do they get a payment from NYISO for curtailing, but many tell us they see NYISO emergency events as a call to help keep the lights on, or a signal that day-ahead electricity prices are high."

The researchers conclude that ISO-administered emergency programs are a necessary complement to RTP or other dynamic retail pricing strategies.

### *Barriers to Price Response*

The majority of customers responding to the survey (85%) reported one or more barriers to price response. The most common barrier, cited by half of survey respondents, was lack of time or resources to monitor day-ahead prices. Although many customers had installed load management equipment or energy information systems, most reported that they do not use them for short-term response to high hourly prices. Goldman notes that, "while automated DR has proven successful in pilot studies, most large customers are not making use of this capability at present. Simply disseminating DR-enabling technologies is not enough – customers need assistance to develop and then automate load response strategies."

Other price-response obstacles reported by customers included institutional barriers within their organization and inadequate incentives to respond.

### *Customer Acceptance and Hedging*

Overall, the researchers find that day-ahead RTP has been well accepted by National Grid's largest customers. Some customers initially had complaints about the choices offered by competitive retailers, but by 2004, the number of

customers switching had increased dramatically. Nonetheless, 34% still remained on default-service RTP.

Most customers have not hedged against price volatility: the researchers estimate that 45 to 60% were fully exposed to day-ahead prices in 2004, either on the default-service tariff, or with an indexed competitive supplier contract. The researchers attribute this to relatively low price volatility combined with customers encountering high-priced hedges in the retail market.

Moreover, Goldman points out that “RTP tariffs indexed to the day-ahead market give large customers some time to respond to high prices by managing their load. Much higher switching rates were observed in New Jersey, where the default-service is indexed to the real-time market and prices are not known until after-the-fact.”

In sum, the researchers conclude that indexing large customers’ default-service electricity tariff to day-ahead market prices is a strategy consistent with the dual goals of promoting DR and retail market development.

The study is titled “Customer Strategies for Responding to Day-Ahead Market Hourly Electricity Pricing” (LBNL-57128), and is authored by Charles Goldman, Nicole Hopper, and Ranjit Bhavvirkar of Lawrence Berkeley National Laboratory, and Bernie Neenan, Richard Boisvert, Peter Cappers, Donna Pratt, Kim Butkins and Lydia Scholle of Neenan Associates. Download it at:  
DRRC website: <http://drcc.lbl.gov/drcc-pubs2.html>  
EETD website: <http://eetd.lbl.gov/EA/EMP/drlm-pubs.html>.

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